SONDAR 2000

Dual Channel Ultrasonic Level Meter

(USER'S MANUAL)

IS Technologies Co., Ltd.

SONDAR 2000

May 2001 Edition

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Chapter 1 Introduction

About SONDAR 2000

The Sondar 2000 is a highly developed ultrasonic level measurement system which provides non-contacting level measurement for a wide variety of applications in liquids.

The Sondar 2000 operates on the principle of timing the echo received from a measured pulse of sound transmitted in air and utilize state of the art echo extraction technology.

The relays and mA outputs may be used as preset(or programmed as desired) to activate alarms and/or operate remote monitoring equipment and/or process control equipment.

The Sondar 2000 has an IP65 lid covering an integral LCD display and 5 buttons used for programming purposes.

The Sondar 2000 also has two independent current outputs and choose one display option among Level1, Level 2, Level 1 – Level 2, Level 2 – Level 1, (Level 1 + Level 2)/2 as user's need.

The Sondar 2000 is composed of a controller and two sensors.

Product Specification

Physical

Dimensions	**controller**	240 (width). x 185 (height) mm
	Sensor	67 (dia) x 160 (height) mm
	mounting	3/4" NPT
	weight	Nominal 3.0 kg
	sensor material	PP

Environmental

IP Rating (electronics housing)	IP65(Controller)
Max. & Min. temperature (electronics)	-20 ºC to +50 ºC(Controller), -20 to +70°C(Sensor)
Pressure	up to 2 Bar

Performance

Accuracy	Less than 0.3% at the full range or 2mm
Resolution	1mm
Max. range	Liquids 8m(logical range : 10m)
Min. range	0.35 meters
Beam Angle	10^{o} at -3dB.
Damping Rate	Adjustable from 0.1m/min to 10m/min
Temperature Compensation	Fully compensated via integral temperature sensor over entire operational span

Outputs

Analogue output 4-20mA into Max 600Ω (user adjustable) Fault condition Alarm 3.8mA / Hold / 21mA user selectable.
Display 2 Line 40 Characters LCD

Programming

On-board programming via 5 tactile push button keys

Supply

Power supply AC 90 ~ 260V, Less than 15VA, DC24V(Option)

Chapter 2 Installation

Sondar 2000 is composed of a controller unit and two sensors

Power Supply Requirements

The Sondar2000 operates from a AC supply of 90 –260V, DC 20V(Option)

> *All electronic products are susceptible to electrostatic shock, so follow proper grounding procedures during installation.*

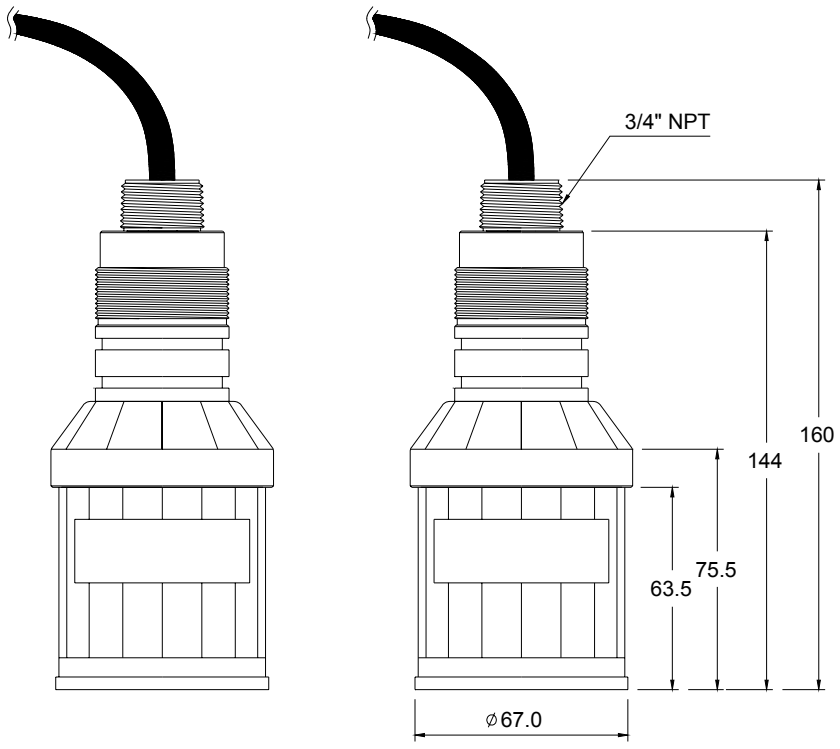
The construction of the sensors can be mounted easily using the thread (3/4" NPT).

When choosing a location to mount the sensor, bear in mind the following:

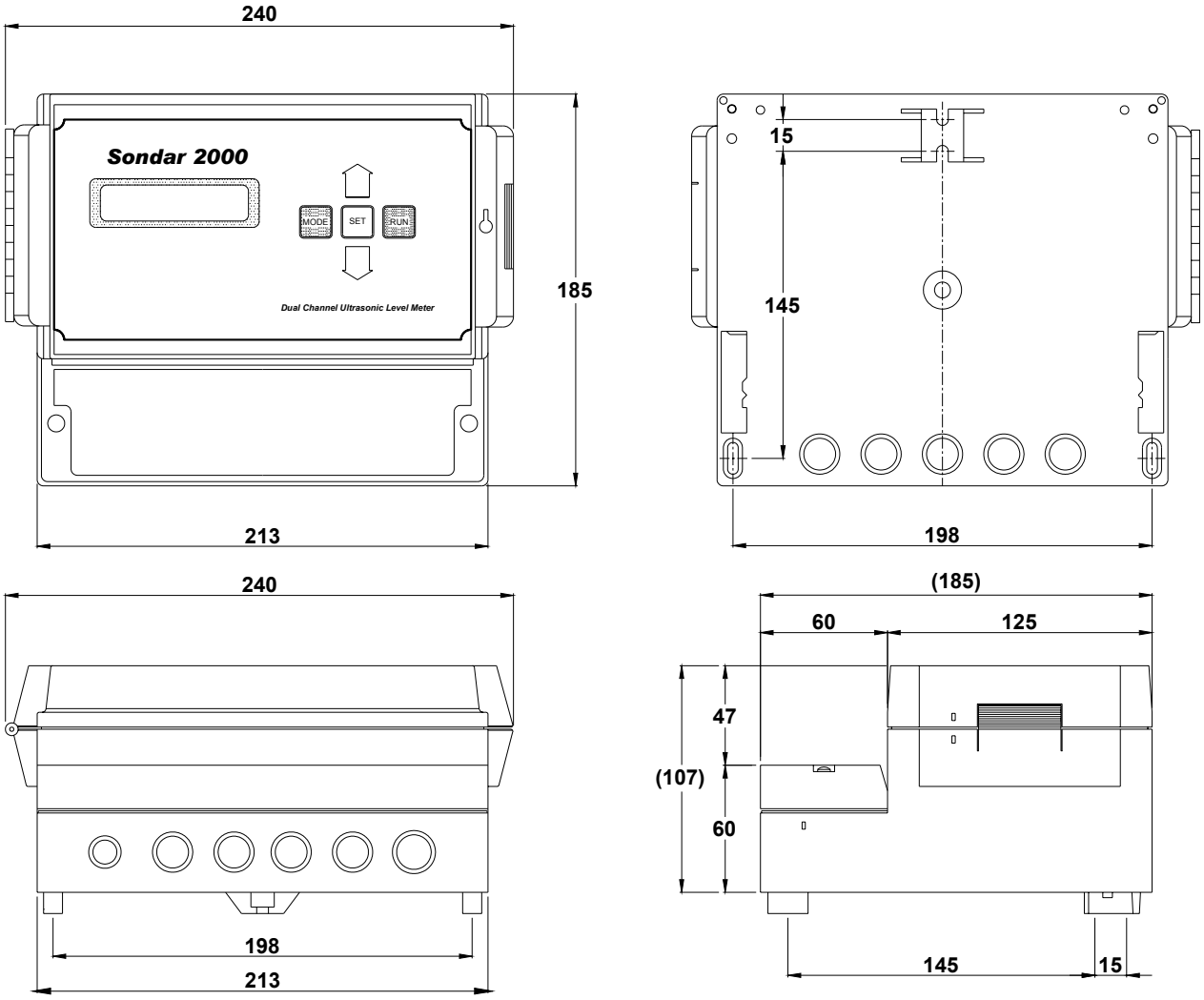
- For easy access to the LCD display and programming buttons mount it where it is easily accessible.
- The ultrasonic signal path should be free of falling material and obstructions such as pipes, beams etc.
- The sensor should be mounted at least 35cm above the maximum level of the material and be perpendicular to the surface.
- The mounting surface should be vibration-free.
- The ambient temperature of the R2000 is between -30ºC and 70ºC.
- There should be no high voltage cables or electrical inverters close by.
- Do not use any metal substances when installing
  (Please use the PVC nut & flange supplied as option)

Dimensions

Sensor



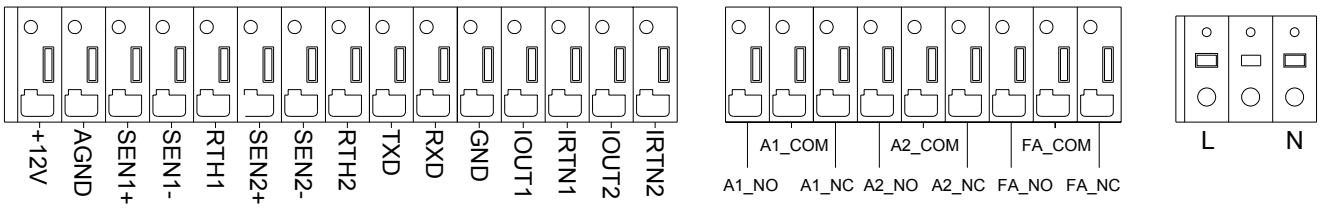
Controller



Cable Entry

26 terminals are aligned inside the terminal box.

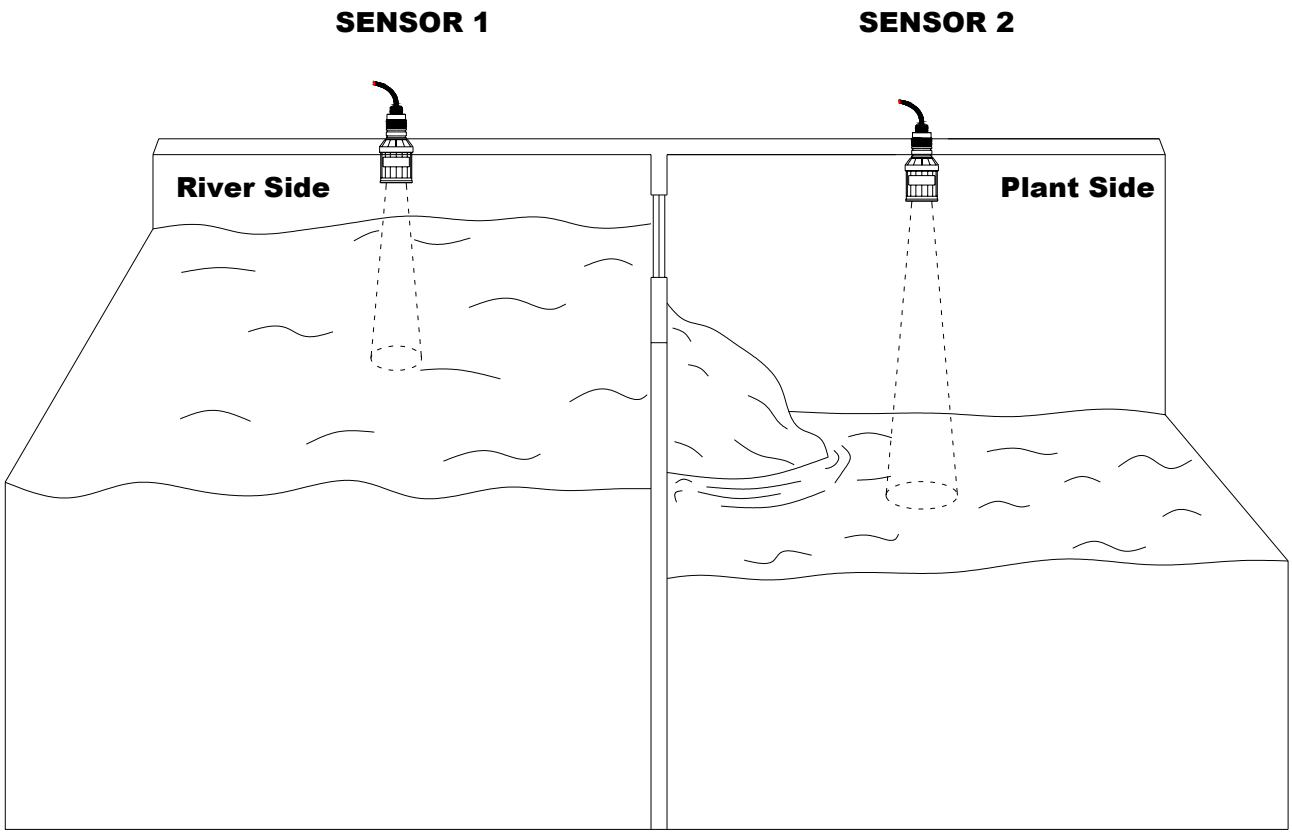
Input & Output Terminal



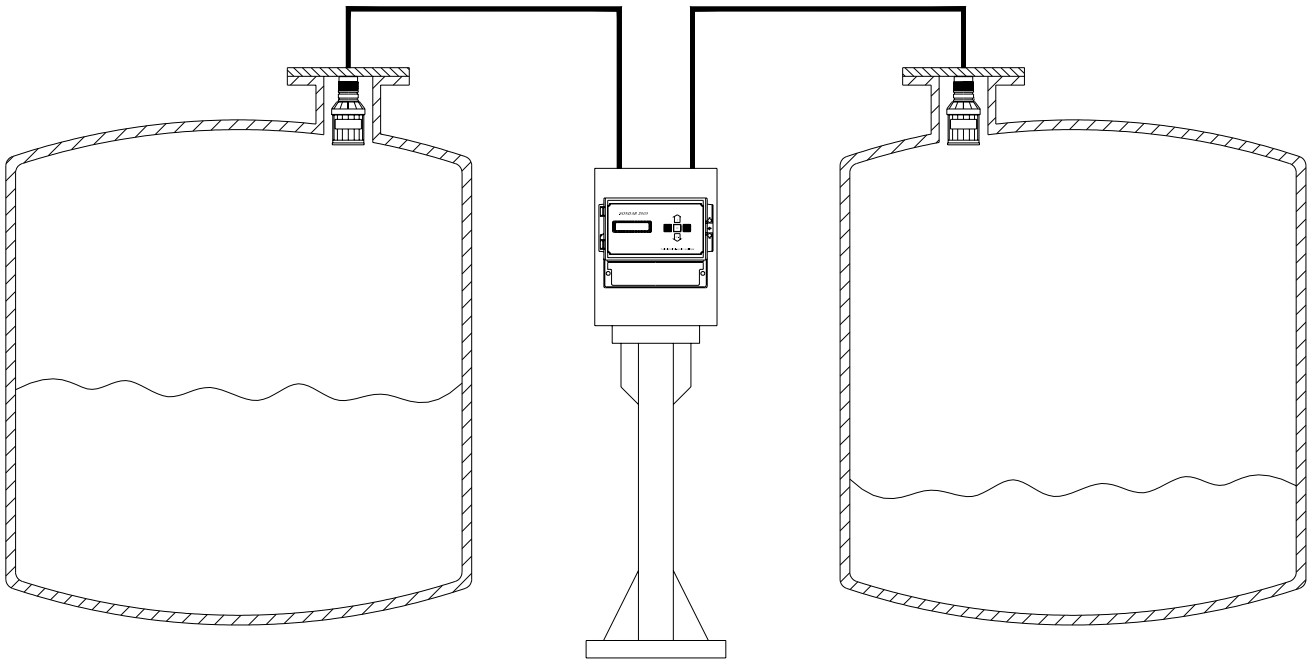
Function

Terminal	Function	Note
+12V	+12V supplied to sensor	
AGND	Connect to GND of sensor	
SEN1+	Connect to positive wire(red) of ultrasonic sensor	
SEN1-	Connect to shield wire(blue) of ultrasonic sensor	
RTH1	It's used at factory	
SEN2+	Connect to positive wire(red) of ultrasonic sensor	
SEN2-	Connect to shield wire(blue) of ultrasonic sensor	
RTH2	It's used at factory	
TXD	RS232C interface in use, connect to transmission part RS485 interface in use, connect to Y	OPTION
RXD	RS232C interface in use, connect to reception part RS485 interface in use, connect to Z	OPTION
GND	GND of digital communication	
IOUT1	Current output No.1	250Ω
IRTN1	Return the current from IOUT1	
IOUT2	Current output No. 2	250Ω
IRTN2	Return the current from IOUT2	
A1_NO	Alarm1 relay NO contact point, OFF with A1_COM together when relay operates.	
A1_COM	Alarm1 relay COM contact point, OFF with A1_NO together when relay operates. OFF with A1_NC together when relay doesn't operate	
A1_NC	Alarm1 relay NC contact point, OFF with A1_COM together when relay doesn't operate.	
A2_NO	Alarm2 relay NO contact point, OFF with A2_COM together when relay operates.	
A2_COM	Alarm2 relay COM contact point, OFF with A2_NO together when relay operates. OFF with A2_NC together when relay doesn't operate	
A2_NC	Alarm2 relay NC contact point, OFF with A2_COM together when relay operates.	
FA_NO	Fail relay NO contact point, OFF with FA_COM together when relay operates.	
FA_COM	Fail relay FA-COM contact point, OFF with FA_NO together when relay operates. OFF with FA_NC when relay doesn't operate.	
FA_NC	Fail relay NC contact point, OFF with FA_COM together when relay doesn't operate	
L	Connect to the line of AC power	
N	Connect to the neutral of AC power	

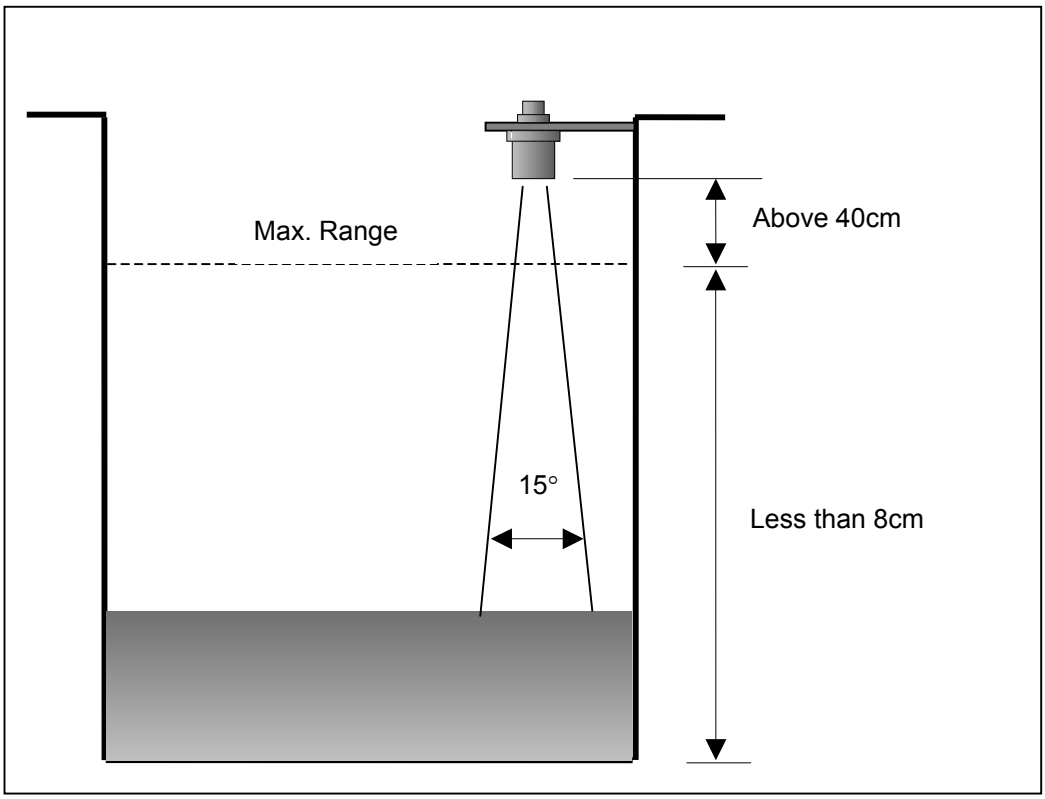
Example 1 – Level Measurement



Example 2 – Point Measurement



Sensor Installation

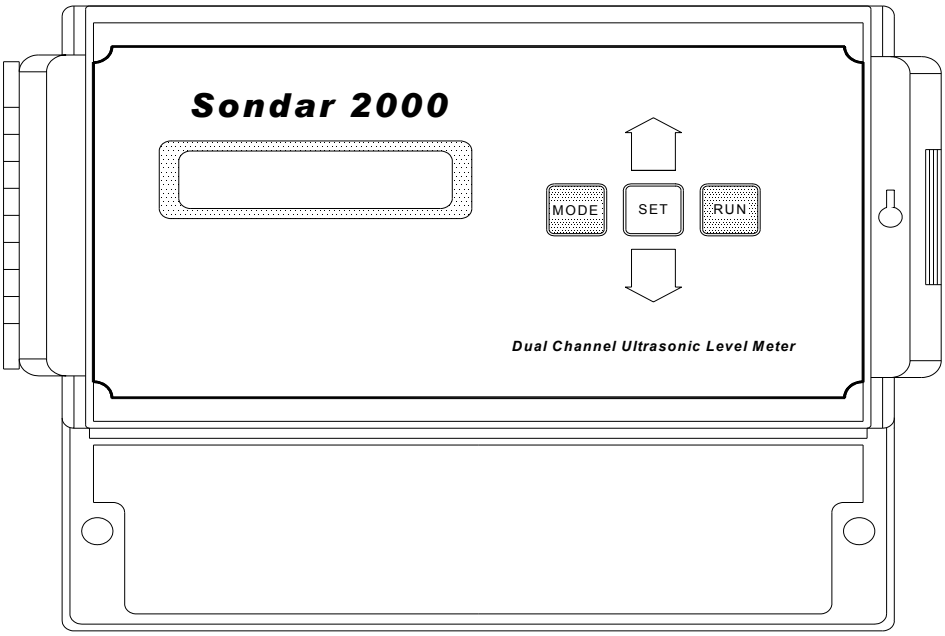


- Recommended Installation -

- Sensor should be installed more than 40cm higher than maximum liquid level.
- There is no obstacle in the ultrasonic beam angle (15°C)
- Sensor should be perpendicular to the liquid level
- To protect the possible error caused by diffused echo reflection, install the sensor in the middle of waterway
- After completing installation, please turn the power off and on again to check if the other program settings are recorded.

Chapter 3 How To Use SONDAR 2000

Operating the Controller



Display Window

S2000 is designed to display various data at the same time by adopting 40 Characters LCD.
The display below shows an example of a normal operation of Sondar 2000.

L1 : 8. 01m L2 : 9 . 01m
DL : 1.00m DT1 A1 A2

1) L1 : 10.01 m → shows the current liquid level of channel 1

2) L2 : 9.00m → shows the current liquid level of channel 2

3) DL : 1.01 m → shows the difference in levels between L1 and L2.

4) DT1 → "D" : Detection. It's flickering when returing echoes are well detected

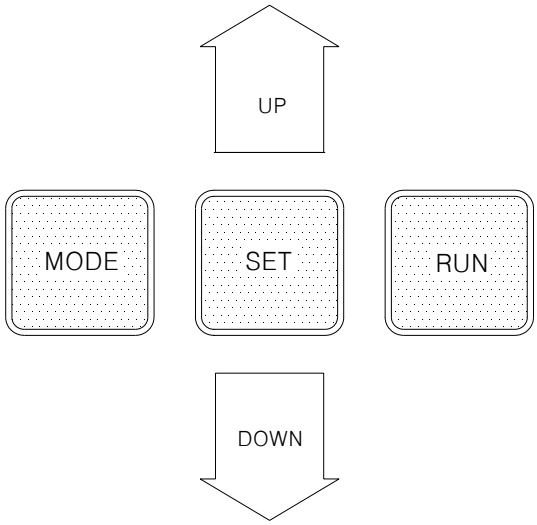
"T" : Transmittion. It also flicker with "D" in normal situation. "D" is flicking alone, it means the target is suddenly changed or there are obstacle in the beam angle

"1" : "D"and "T" are the situation of channel 1

5) A1 → shows relay 1 is in operation.

6) A2 → shows relay 2 is in operation.

Button Functions



*** MODE Button**
- Use this button only once to get into menu mode

*** SET Button**
- This button is used for 2 main purposes.
  1) To set the value after choosing Menu option by pressing UP or DOWN button.
  2) To save the value

*** UP and DOWN Button**
- These buttons are used to choose menu and set data

*** RUN Button**
- Use this button only once to return to operation mode

Checking up on operation status

- The below window is seen by pressing UP button at Run Mode.
  SIG means the power of reflected echo. THR means threshold voltage.
  Normally the value of SIG should be bigger than the one of THR

SIG1:□□	**SIG2:□□**
THR1:□□	**THR2:□□**

- The below window is seen by pressing DOWN button in operation.
  D1 means Distance(from the sensor to liquid level) of channel 1 and T1 is Temperature of channel 1

D 1: □□.□□m	**D 2: □□.□□m**
T1 : □□℃	**T 2 : □□℃**

Current Output

- The Sondar 2000 has two respective current outputs to level change. User can choose two current outputs among below options.

  - CH1 LEVEL
  - CH2 LEVEL
  - CH1 LEVEL – CH2 LEVEL
  - CH2 LEVEL – CH1 LEVEL
  - (CH1 LEVEL + CH2 LEVEL) / 2

Alarm Relay

- The Sondar 2000 has two alarm relays
  The relays are normally used for pump control, draining control, high and low liquid level warning, etc. at user's need

Chapter 4 Menu Guide

Application Menu Option

Password

Factory Set= 0

This option is displayed by pressing MODE button. The factory set is “0”.
After inputting “0”, move to next menu by pressing SET button

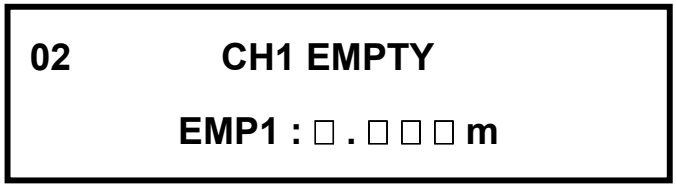
Password Change

At this option, you can change the password by pressing SET button.
If you don’t need it, you can move to next menu by pressing UP or DOWN button.

Channel 1 Empty Distance

FactorySet=5.000m

This option sets the maximum distance from the face of the channel 1 sensor to the empty point, in meters.
Press the SET button to set the value and use UP or DOWN button to input value
Below are the window when setting the value



Channel 2 Empty

FactorySet=5.000m

This option sets the maximum distance from the face of the channel 2 sensor to the empty point

Channel 1 Blanking Distance

FactorySet=0.350m

This option is the distance from the face of the transducer that is not capable of being measured, and is pre-set to 35cm. It should not be set to less than this figure, but can be increased if required.

Channel 2 Blanking Distance

FactorySet=0.350m

This option sets blanking distance of channel 2

Process Menu Options

Channel 1 Current Output

FactorySet= 1

This option is to choose mA output for channel 1.

1. CH1 LEVEL
2. CH2 LEVEL
3. CH1 LEVEL - CH2 LEVEL
4. CH2 LEVEL - CH1 LEVEL
5. (CH1 LEVEL + CH2 LEVEL) / 2

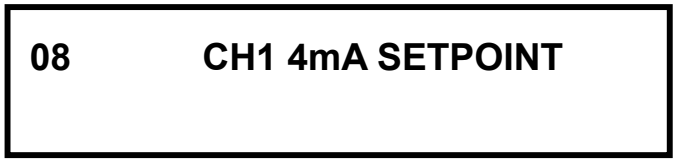
Channel 2 Current Output

FactorySet= 2

This option is to chooses mA output for channel 2

Channel 1 4mA Setpoint

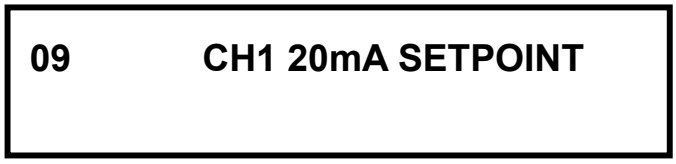
Factory Set = 0



This option sets the level at which the 4mA output will occur. By default 4mA will represent **Empty**(0% of Span).

Channel 1 20mA Setpoint

FactorySet=5.000m



This option sets the level at which the 20mA output will occur. By default 20mA will represent **Full** (100% of Span)

Channel 2 4mA Setpoint

FactorySet = 0

10	CH2 4mA SETPOINT

This option sets 4mA setpoint of channel 2

Channel 2 20mA Setpoint

FactorySet = 5.000m

11	CH2 20mA SETPOINT

This option sets 20mA setpoint of channel 2

Alarm Operation

FactorySet = 1

12	ALARM OPERATION

This option chooses the object of alarm relay

1. CH1 LEVEL
2. CH2 LEVEL
3. CH1 LEVEL - CH2 LEVEL
4. CH2 LEVEL - CH1 LEVEL

Alarm 1 ON Point

FactorySet = 1.000m

13	ALARM1 ON POINT

This option determines the “ON” point for A1 relay.

Alarm 1 OFF Point

FactorySet = 1.100m

14 ALARM1 OFF POINT

This option determines the limit "OFF" point for A1 relay.

Alarm 2 On Point

FactorySet = 8.000m

15 ALARM2 ON POINT

This option determines the limit "ON" point for A2 relay

Alarm 2 Off Point

FactorySet = 7.900m

16 ALARM2 OFF POINT

This option determines the " OFF" point for A2 relay.

Channel 1 Damping Rate

FactorySet = 2

17 CH1 DAMPING RATE

This option determines the maximum rate at which the unit will respond to an increase/decrease in level.

1 = 0.1m/min
2 = 0.5/min
3 = 1m/min
4 = 10m/min

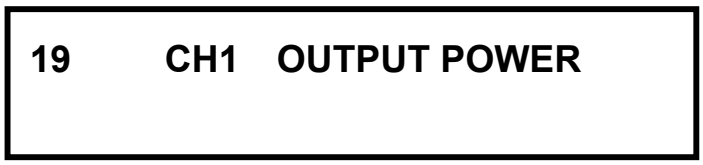
Channel 2 Damping Rate

FactorySet = 2

This option sets the damping rate of channel 2

Channel 1 Ouput Power

FactorySet = 3

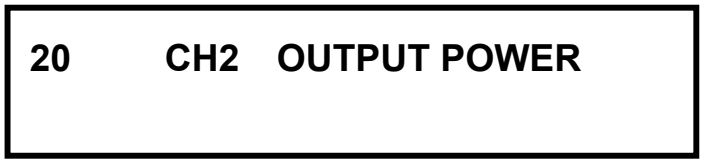


This option is used to set the power output from the sensor to suit varying applications. By reducing the power emitted the beam angle will be effectively reduced and can be applied as detailed below;

- Setting Range : 1 = Minimum Power
  (For use on short range applications)
  2 = Low Power
  (For use on applications where obstructions such as pipes, beams etc. are present)
  3 = Normal Power
  (For use in normal condition)
  4 or 5 = High Power
  (For use in arduous applications where conditions are dusty, steamy or turbulent)

Channel 2 Ouput Power

FactorySet = 3



This option sets output power of channel 2

Compensation Menu Options

Detect Level

FactorySet = 4

CH1 DETECT LEVEL

This option determines detectable size of return echo. This is useful when the first return echo is needed in condition where small objects creating various kinds of return echoes exist. In case the set value is big, it can be stronger to the noise, but may not be able to detect small echo.

Detect Level

FactorySet = 4

CH2 DETECT LEVEL

This option sets the detect level of channel 2

Fail Safe Current

FactorySet = 4

FAIL SAFE CURRENT

If the Sondar 2000 fails to receive a valid echo return from the target, then the mA output can be used to indicate a fault condition (Lost of Echo). 3.8mA, 21mA or HOLD is selectable at user's need.

Fail Safe Time

FactorySet = 120

FAIL SAFE TIME

In the event of a fail-safe condition occurring (Lost of Echo) the fail safe timer determines the time before the mA output indicates a fault condition (Lost of Echo)

Sound Velocity

FactorySet = 331.6

SOUND VELOCITY SET

This option allows for the velocity of sound to be changed according to the atmosphere the sensor is operating in. By default the velocity is set for sound travelling in air at a temperature of 0°C.

The table below gives details of the velocity of sound in various gaseous atmospheres In all cases the velocity indicated is that in a 100% gaseous atmosphere at 0°C. In atmospheres less than 100% it may be necessary to check the level indicated at near empty and near full and compare with the actual level, several times, then adjust the **Sound Velocity** accordingly to obtain an accurately displayed reading.

Gas	Sound Velocity
Chlorine	206 m/sec
Carbon Dioxide.	259 m/sec
Argon	308 m/sec
Oxygen	316 m/sec
Air	331.6 m/sec
Ammonia	415 m/sec
Methane	430 m/sec
Helium	435 m/sec
Neon	965 m/sec

Velocity Temperature Factor

FactorySet = 0.60

TEMP FACTOR

The sound velocity in air increases or decreases at fixed rate(0.6m/ ℃), however in atmospheres other than air it will change at a different rate.
This option allows the rate of change in m/°C to be set according to the present atmosphere and temperature. The level indicated, should be compared with the actual level, several times, then Velocity Temperature factor adjusted accordingly, to obtain an accurately displayed reading.

Sensor Select

FactorySet
=Sensor1&2 On

SENSOR SELECT

This option chooses the operation sensor channel. In case only one sensor is in use, you can simply choose the sensor you want to operate.

12mA Output

Sondar 2000 outputs 12mA regardless of measurement at this mode.
This option is useful when testing with other equipment.

Menu Option Record

APPLICATION

Option Details		Entered Value					
No.	**Description**	**Factory Set**	**Value Range**	1	2	3	4
	PASSWORD CHECK	0	-				
01	PASSWORD CHANGE	0	0 ~ 1000				
02	CH1 EMPTY	5.000m	0 ~ 9.999m				
03	CH2 EMPTY	5.000m	0 ~ 9.999m				
04	CH1 BLANKING	0.350m	0 ~ 9.999m				
05	CH2 BLANKING	0.350m	0 ~ 9.999				

PROCESS

06	CH1 OUT CURRENT	1	1,2,3,4,5				
07	CH2 OUT CURRENT	2	1,2,3,4,5,				
08	CH1 4mA SETPOINT	0m	0 ~ 9.999m				
09	CH1 20mA SETPOINT	5.000m	0 ~ 9.999m				
10	CH2 4mA SETPOINT	0m	0 ~ 9.999m				
11	CH2 20mA SETPOINT	5.000m	0 ~ 9.999m				
12	ALARM OPERATION	1	0 ~ 9.999m				
13	ALARM1 ON POINT	1.000m	0 ~ 9.999m				
14	ALARM1 OFF POINT	1.100m	0 ~ 9.999m				
15	ALARM2 ON POINT	8.000m	0 ~ 9.999m				
16	ALARM2 OFF POINT	7.900m	0 ~ 9.999m				
17	CH1 DAMPING RATE	2	1,2,3,4				
18	CH2 DAMPING RATE	2	1,2,3,4				
19	CH1 OUTPUT POWER	3	1,2,3,4,5				
20	CH2 OUTPUT POWER	3	1,2,3,4,5				

COMPENSATION

21	CH1 DETECT LEVEL	4	3~15				
22	CH2 DETECT LEVEL	4	3 ~15				
23	FAIL SAFE CURRENT	4	3.8mA/Hold/21mA				
24	FAIL SAFE TIME	120	20~999				
25	SOUND VELOCITY SET	331.6	200.0~500.0				
26	TEMP FACTOR	0.60	-2.0 ~ 2.0				
27	SENSOR SELECT	SENSOR 1&2 ON					
28	12mA OUTPUT						